DOCUMENT RESUME

ED 191 446 IR 008 678

AUTHOR Meyer, Richard W.; And Others
TITLE Total Integrated Library Information System. A Report on the General Design Phase.
INSTITUTION Clemson Univ., S.C. Robert Muldrow Cooper Library.
PUB DATE 31 Mar 80
NOTE 76p.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *College Libraries; Cost Effectiveness; Feasibility Studies; Higher Education; *Library Automation; Library Services; Library Technical Processes; Online Systems; *Serials; *Systems Development

ABSTRACT

This report on an IBM-assisted Application Transfer Team study by Clemson University Library to develop planning for and design of an integrated library automation system concentrates on the design of a serials subsystem. Data gathered from students, faculty, and library staff members through the structured interview technique focused on interfaces between units, on problems, on volumes and cycles of activity, and on discernable improvements and benefits. The report describes the current library system environment, the objectives of the proposed system, the system itself, implementation considerations, and a plan of action. Recommendations and a cost-benefit analysis are provided. (FM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED191446

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

TOTAL INTEGRATED LIBRARY INFORMATION SYSTEM

A REPORT ON THE GENERAL DESIGN PHASE

MARCH 31, 1980

by

Richard W. Meyer, Chair
George Alexander
Frances Colburn
Frank Diaz
Robert Kelly
Beth Reuland

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Richard W. Meyer

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ROBERT MULDROW COOPER LIBRARY

CLEMSON UNIVERSITY

IR008678

ABSTRACT

This document reports on an IBM assisted Application Transfer Team study by Clemson Library to develop planning for and design of an integrated library automation system. Because of the broad scope of library activities the study concentrates on the design of a Serials subsystem. The methodology which was used is founded on a structured interview technique applied to all parties or units interacting with serial publications or Serials operations. Those interviewed at Clemson included students and faculty and the staff members from Acquisitions, Serials, Cataloging, Reference, and Circulation areas as well as branch library staff and University business office staff. Information on interfaces, problems, improvements, benefits, volumes of activity, and trends were collected in each interview. From the data gathered a merged assessment of the Library environment, problems associated with the Library and the expected benefits attendent on solving those problems was developed. This assessment, in turn, was used to design a serials subsystem which would meet the needs of the Library. The costs and benefits of the subsystem were determined and are included in the report. The final recommendation and a plan of action conclude the report.

I. PREFACE

Demands for Library Services have been growing steadily over the past two decades. At a research institution like Clemson some contributing factors which increase demand include the growth in the amount of scholarly publishing, greater pressure and more complicated procedures to develop research proposals, and greater diversity of information. The growing needs for services are overwhelming manual procedures to provide them. As a result, it has become necessary for the Cooper Library staff to seek ways to automate numerous service functions. This requires planning founded upon a tested methodology. A proven planning technique was located through the major vendor who provides computing technology to Clemson.

In November 1979, with the endorsement of Dr. Victor Hurst, Vice President for Academic Affairs and Dean of the University, the Library accepted an offer from IBM Corporation to assist with the development of a Library automation plan. This assistance was to be in the form of guidance in the implementation of an Education Industry Application Transfer Team study. It was understood that the purpose of the Application Transfer Team effort was to develop planning for and design of a Library Automation system. The Library system was to be designed to allow upgrading of any current systems, and implementation of new systems in such a fashion that each would integrate with the others and with current University wide systems such as the student data base.

A joint Clemson/IBM team was organized to accomplish this task. Dr. Arnold Schwartz, Dean of Graduate School and chief administrator of the Clemson computing and data processing operations accepted the role of

executive sponsor for the library project. This report is a summary of the Application Transfer Team efforts.

The Application Transfer Team was composed of the individuals listed below:

Library:

Frances Colburn, Librarian in Charge of Circulation

Frank Diaz, Reference Librarian, S&T

Richard Meyer, Associate Director, Team Chair

Beth Reuland, Serials Cataloger

Division of Administrative Programming Services:

George Alexander, Director

IBM Corporation:

Robert Alexander, Education Industry Specialist

Robert Kelly, Marketing Representative

William Turner, Systems Engineer

Additional participants included: Robbie Barringer and Gene Puckett of IBM; Ann Sprouse of DAPS; and Larry Wood and Janet Sprouse of the Library.

II. TABLE OF CONTENTS

		Page
I.	PREFACE	1
II.	TABLE OF CONTENTS	3
III.	INTRODUCTION	5
	A. Background	5
	B. Methodology	6
IV.	EXECUTIVE SUMMARY	8
	A. Background	8
	B. Purpose and Method	9
	C. Benefits/Cost Summary	10
	D. Recommendations	12
V.	CURRENT LIBRARY SYSTEM ENVIRONMENT	13
	A. Library Mission and Objectives	13
	B. Organization	13
	C. Information Flow	17
	D. Problems/Needs	17
	E. A Special Problem	22
	F. System Requirements	23
VI.	OBJECTIVES OF PROPOSED SYSTEM	27
VII.	SYSTEM DESCRIPTION	29
	A. Introduction	29
	B. Database Description	32
	C. Table of Data Elements	36
	D. Module Description	40
	E. Other Library Subsystems	45

		Page
VIII.	IMPLEMENTATION CONSIDERATIONS	47
	A. Introduction	47
	B. Alternatives	48
	C. Cost Estimates	52
	D. Summary	55
IX.	COSTS/BENEFITS ANALYSIS	57
	A. Introduction	57
	B. Costs	58
	C. Benefits	59
	D. Cost/Benefits Match	66
	E. Potential Payback	67
X.	RECOMMENDATIONS AND PLAN OF ACTION	70
	A. Introduction	70
	B. Strategy	71
Appendix		
	ATT Study Notes	

III. INTRODUCTION

A. Background

It is apparent that as Library Services proliferate and disperse, and as collections and service demands increase, that many functions in the Library have outgrown the capability of manual systems. For instance, the Clemson Library book, periodical and binding allocation has increased at a rate of better than ten percent per year from $275,000 to $929,000 over the past twelve years. During this same period of time the Library has added an average of 21,767 volumes per year while growing from 242,530 to 503,742 volumes. The overall library budget has increased from $545,600 to $2,153,761. The impact of users has resulted in an increase of circulation from 99,380 to 202,445 items per year. Finally, the serials collection has grown from 5,946 to 13,058 titles. At the same time the staff has grown from 47 to 78, while total salaries have increased from $239,455 to $996,929. Simple projection of those figures indicate that, while circulation will reach 300,000 or more by 1985, the total salaries of the staff necessary to handle the volume of activity manually will pass the $2,000,000 mark at that same time.

Acquisitions and Circulation functions, in particular, become less manageable as volume of activity increases and as purchasing demands overburden the funds available. Additionally, as a result of proliferation in information, the capability decreases of manual catalogs to keep current and to provide adequate access to collections. The problems are particularly acerbated for serial publications due to the rapid increase in cost of individual titles and the evergrowing number of new titles. These problems are compounded by high inflation in regard to manpower costs.

Furthermore, it is becoming increasingly attractive to investigate automated solutions because of the leveling or even decreasing costs of machine oriented systems for data storage and bibliographic record manipulation. In order to plan appropriate systems to overcome these problems in the individual cases of acquisition, cataloging and serials control it is necessary to see that various library automation efforts are linked to each other and to other university systems.

As an initial part of planning, the Library administration decided to implement a programmed study to determine the specific needs and problems at Clemson and to determine the cost and benefits associated with meeting the needs and solving the problems. To develop the methodology for this kind of study effort inhouse has been shown by experience elsewhere to be both expensive and time consuming. Therefore, a planning methodology was sought which could be brought in from outside the Library and applied in a timely fasion. The IBM Corporation, through their local marketing representative volunteered to supply that methodology by means of an Education Industry Application Transfer Team study. In order to implement the study a team was organized consisting of representatives from the library, from DAPS and from IBM.

B. Methodology

The joint Clemson/IBM Application Transfer Team utilized a planning/design methodology which has been used successfully at other colleges and universities (University of Minnesota, Stanford, University of Missouri, and Louisiana State University).

The methodology used a structured interview technique to determine the information needed to design a system which could support library operations while providing improved services to all users. The interviews were conducted with staff of each potential application area in the Library, with both student and faculty user groups, and with university personnel routinely involved in business interactions with the Library. The sessions were conducted in order to determine interactive relationships between components, needs and concerns, possible improvements, potential benefits of improvements, cycles and volumes of activity, and trends in activity.

The architectural design effort concentrated on the *what* not *how*. The system design describes the characteristics and functions without detail on technical approaches to program module design.

A cost/benefit analysis was developed based upon estimates of system development expenditures compared to expected benefits. Detailed estimates were developed for part of the system and extrapolations were made to generate an estimate of the overall inhouse system development costs.

Scheduled reviews of the interview findings and the results of the Team's activity were conducted with the executive sponsor to help assure adequate direction and project support.

IV. EXECUTIVE SUMMARY

A. Background

Robert Muldrow Cooper Library of Clemson University in fulfillment of its mission has the responsibility of acquiring, preserving and making available for use the many materials needed by faculty and students in their research and instructional efforts. These materials range widely in scope, size, format and content and they include books, serials, periodicals, newspapers, documents, reports, pamphlets, manuscripts, music scores, maps and microforms. The information contained in these materials is sought actively and urgently by users with a variety of needs.

Demands for Library services and the diversity of information needs at Clemson have increased over the years to the extent that they are overwhelming the capability of manual systems. Demands for services have doubled over the past decade, but the costs of meeting the demands have quadrupled. At the same time, information needs have become so sophisticated and require such quick gratification that manual library procecures often are unable to satisfy. The Library staff has sought to find a way through automation to reduce the rate of rise in costs while simultaneously increasing service effectiveness. In order to facilitate the process of automating procedures a plan was required.

The planning methodology selected by the Library administration was the Application Transfer Team study technique designed and refined by IBM. Personnel from IBM assisted Clemson Library with the execution of its study.

B. Purpose and Method

It was the intent of the study to develop planning for the design of an integrated library system. Since each functional area of the library links with other areas and with other parts of the campus, it was deemed important to design automated systems for acquisitions, serials, cataloging and circulation which interconnect expediently with each other. The scope of the project appeared to be beyond the capability of the team if it required an exhaustive study for each functional area. Since serials, however, encompasses the problems of acquisitions and bibliographic control and since serials also reflects the most complicated area for storage and retrieval, the team study focused on this area. This approach allowed the team to cover the important concerns in all areas and develop the requirements of an integrated system while limiting concentrated design effort to serials.

The approach utilized is founded upon a structured interview technique, which determined the information needed to design a system which could support library operations while providing improved services to users. The perceptions gathered from staff in each area were concentrated on interfaces between units, on problems, on volumes and cycles of activity, and on discernable improvements and benefits. This information was consolidated to focus the most important issues as input to the design of the architecture and program modules needed for an automated system. Working from the design and data collected, estimates were made of programming costs by using a formula refined by IBM. These costs were then compared to the benefits deriving from a system in order to arrive at an implementation strategy and a recommended course of action.

C. Benefits/Cost Summary

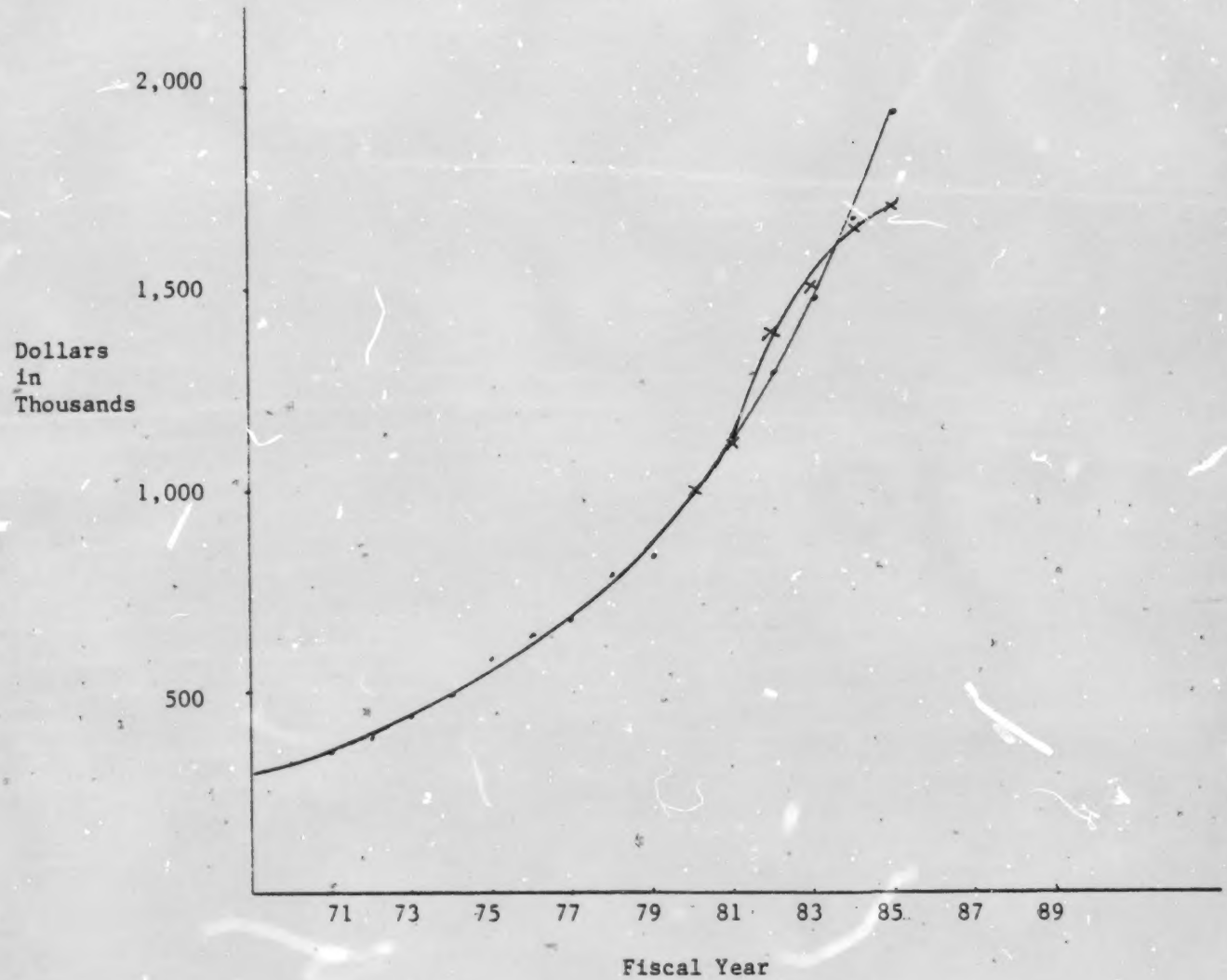
The graph in figure 1 demonstrates the differences between continued services by manual methods compared to automated methods. This graph reflects personnel cost considerations only, which will, over the long term, result in real dollar savings to the university, but it does not reflect the significant benefits deriving from improved access to the information stored in the Library. The real return on investment in an integrated library system will come from services which will allow students and faculty to have remote and broader access to library holdings. That access will in turn result in research proposals which have a greater chance of success, thus bringing greater dollar rewards to the University. For students, the improved access will result in exposure to a more diverse and expanded body of information which will in turn mean a better education for them.

The potential payback of an automated system is $502,000 in personnel savings versus $320,000 in program development personnel costs which result in a net savings excepting data conversion of $182,000. These savings largely may be washed out by hardware costs, and by computer operating costs over the short term. However, the major benefits of the automated system which are not quantifiable include greatly increased accessability, improved service, and improved responsiveness of the library to campus needs. An integrated library system also will provide equal access to all items in the Library. These non-quantifiable benefits largely overwhelm cost considerations. It should also be recognized that inhouse development represents a worse case situation and that implementation of an outside system will realize greater cost savings.

Figure 1: Manpower costs assuming no automation compared to manpower costs with automation.

x - automation

. - no automation



D. Recommendations

The implementation of an integrated library automation system, which will proceed in a series of steps as shown below, is recommended for the Clemson University Library.

1. Upgrade the current circulation system to provide online access to patron and books in circulation files.

2. Identify, evaluate and acquire a currently available library system which will provide for serials acquisitions and control and which will be capable of upgrading to an integrated library system.

3. Begin conversion of serials information to a machine readable format with consistent entries controlled by an authority control procedure.

4. Install and implement the serials system.

5. Implement modifications of the system to allow its use for monograph acquisitions.

6. Upgrade the current circulation database or convert the shelflist and load to accomodate replacement of the card catalog with an online catalog.

7. Develop and implement online circulation and management information modules.

V. CURRENT LIBRARY SYSTEM ENVIRONMENT

A. Library Mission

The Robert Muldrow Cooper Library of Clemson University represents one of the greatest academic resources of the university. The library supports the university by acquiring, preserving and making available for use the library materials which are necessary for the instructional and research programs of the university. To remain strong and to meet all future challenges, the library must be receptive to changes and new developments in the field. Keeping abreast of change and implementing improvements in services through technology insures mutual growh and excellence for the library, the university, and the state.

B. Library Organizational Structure

The library is divided into seven functional units or service areas which are coordinated by the Director and Associate Director. The library administration further communicates the library's needs and concerns to the university administration. The functional units of the library are represented in Figure 2 and are each described here.

Acquisitions: The principal role of this service is to acquire monographic materials (e.g. books) for the library. For the fiscal year 1978-79, the expenditure for monographs was $228,973.55. The responsibility of this unit basically described includes: verifying bibliographic information, ordering information, and prices; ordering materials from vendors and/or

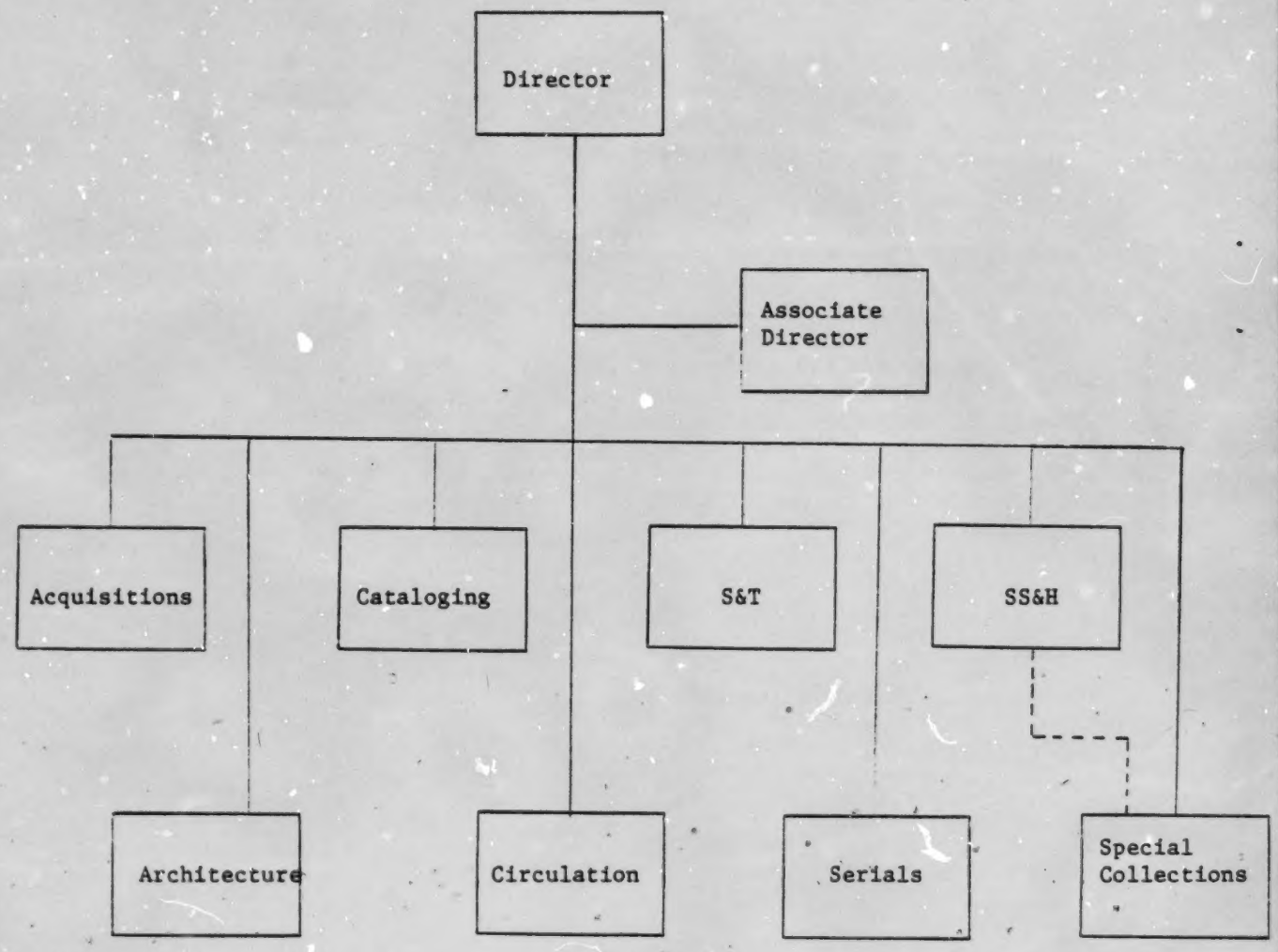


Figure 2: Organizational chart of the library

publishers; receiving the materials; passing items to Cataloging for processing.

Serials: The role of serials is similar to that of Acquisitions but due to the difference in the nature of the materials acquired, its procedures, problems, and budget are greater. Serials receives most of the library's mail and sorts it for the other library units. All serial issues are recorded in a check-in file. First issues of a new journal, after check-in, are taken to Cataloging for further processing. After returning from Cataloging, all subsequent issues, until bound, are shelved in the current shelves of either the first floor for SS&H or second floor for S&T. Serials is responsible for maintaining the visible file. This file gives holdings information -- call number, volumes, years, location, binding information, formats -- for periodicals and some other publications. Serials does the bulk of the binding for the library. Binding consists in collecting individual issues and sending these to a commercial bindery. Other Serial functions include: claiming of missing issues from publishers and/or vendors and securing backfiles -- individual issues or volumes that the library lacks -- to complete holdings. The 1978-79 fiscal year budget for all Serial acquisitions was $580,909.58.

Cataloging: The function of this unit is to process both monographs and serials before circulation. It is here that call numbers are assigned. The library is a member of OCLC (OCLC, Inc.; formerly the Ohio College Library Center). This membership allows the library to participate in many OCLC services such as: inputing and sharing cataloging information with other participating libraries, ordering cards for the card catalog,

and participating in the interlibrary loans subsystem. Besides assignment of call numbers, Cataloging assigns subject headings and maintains the main card catalog -- creating and filing new cards, revising subject headings, and making other card changes. Cataloging also maintains a shelflist. This is a file in which cards are sorted by call number, e.g., in the same order as items on the Library shelves. After books or bound serials are processed, they are ready for circulation.

Circulation: This unit of the library is responsible for circulating monographic materials. Other functions include: shelving, sending out notices, sending out recalls, maintaining a reserve desk.

Special Collections: This unit of the library is responsible for the South Carolina room. In this collection are found publications about South Carolina or items written by South Carolinians. This unit also maintains various manuscript materials and rare books.

Social Sciences and Humanities Reference (SS&H): This unit operates a general reference desk. It handles all questions for the social sciences and humanities and refers science and technology questions to the Science and Technology desk. Other duties besides providing reference service include: preparing subject bibliographies, providing formal bibliographic instruction (classroom), providing an interlibrary loans service, performing online bibliographic services (Lockheed DIALOG bibliographic retrieval). The U.S. Government Documents office is also part of this unit.

Science and Technology Reference (S&T): This service provides reference for all areas of science, technology, agriculture, etc. The other services provided are similar to those of SS&H reference. The bulk of online bibliographic retrieval is conducted by this unit. The Agricultural Information office is a subunit of this service.

Architecture Library: This is the only branch library of the main library. There are several departmental libraries including Sirrine, Chemistry, Physics, and Horticulture.

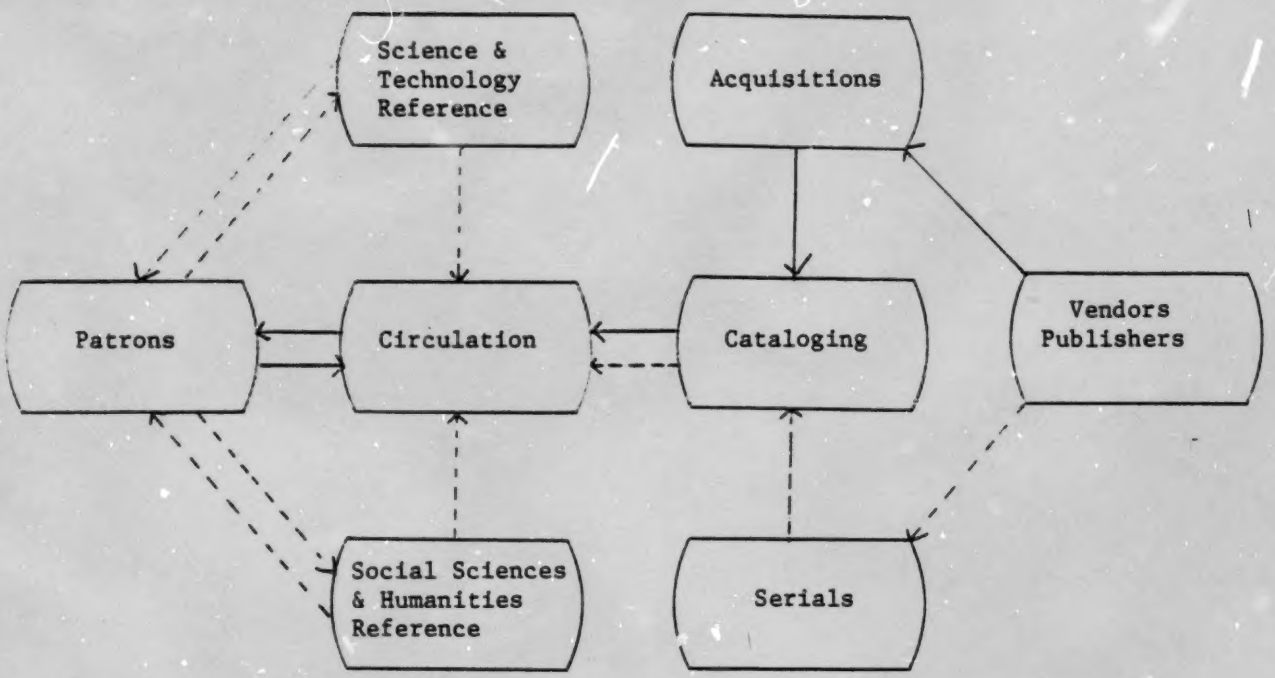
C. Information Flow

The flow of incoming materials is diagrammed in Figure 3. The interactive relationships of functional units is diagrammed in Figure 4.

D. Problems and Needs

During the course of the Application Transfer Project, and following several university and library wide interviews, most problem areas in the Library drew into focus. These problem areas were separated into two groups; system oriented and non-system oriented. The non-system oriented problems, which are policy related, fall outside of the scope of this report, but because they have been identified they can and will be dealt with through administrative channels.

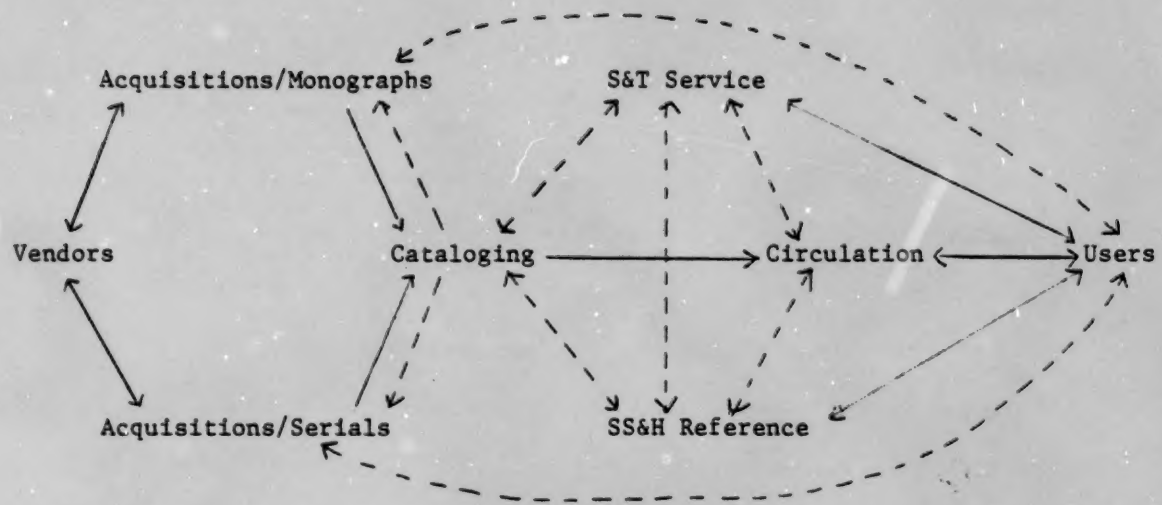
The problems which are amenable to a solution based on automation derive from the fundamental issue of access. Lack of complete access to current information and to status of materials results in significant user



Monographs _____

Serials _ _ _ _ _ _ _ _ _

Figure 3 : Materials flow for serials and monographs



_ _ _ _ _ Light

_____Heavy

Figure 4: Interactive relationships between units

frustration and to ineffective services. The traditional nature of library work which involves labor intensive, repetitive operations, the lack of a single, all encomposing, central information control technology, and the lack of comprehensive management information all combine to result in inadequately coordinated, mistake-prone services. Implementing a system which will deal effectively with the problems enumerated below will result in a library operation which adequately addresses the issues.

The most significant of the system oriented problem areas is access. The library has tremendous resources; monographs, serials, microforms, U.S. government publications, experiment station publications, extension publications and others. Many patrons believe that the card catalog lists or represents all of the library's holdings. This is not true. Many materials such as documents and microforms are not represented in the Catalog. Serials, which are particularly important at Clemson, are represented only as individual titles while little or no access to document serials and microforms is provided. Other access-related problems involve the physical location of materials, of equipment, and of services. The tracking of materials through different units of the library during processing presents still another access problem.

These access related problems stem, in part, from problems with files. There are too many files dispersed throughout the library. Due to their physical location, even access to these files presents a problem. Some of these files are duplicates while others contain unique information. Other file related problems include timeliness of information in the file, interpretation of file information, and information/file selection.

Another major problem area is duplication of effort. This encompasses the replication of the same or similar tasks by different units, or even

within the same unit, of the library. Problems here include input of similar information by different units of the library into files, multiple searching for bibliographic information, multiple card catalogs, duplication of fund control and access, and duplicative use of data from the OCLC system. Duplication of effort involves the dispersion of various services. Interlibrary loan service is dispersed into two library units. Binding is dispersed into several library units.

Many tasks and operations in the library are very time consuming. Examples include: maintenance of the two card catalogs -- filing, revising, and the cataloging process itself; the acquisitions process; manual checking of the batch generated borrowers list; manual circulation of special charges (journals, government publications, and theses), serials cataloging; interlibrary loans; and online bibliographic retrieval.

Circulation problems are encountered in the charging of books. Charging problems include: keypunch errors in producing the charge cards, charge/discharge problems of same day transactions, fines control, manual circulation of many publications, inability to conduct transactions during transmission of charging information to the Computer Center, poor quality of the communication line to the Computer Center, lack of identification information for many borrowers, lack of information on user status (i.e., how many journals checked out?, how many books overdue?). Problems are also encountered with the sending of recalls for patrons to bring back library materials.

The claiming of materials from publishers, vendors, and government agencies is also a problem for the library which chiefly derives from knowing when to claim. The present procedure is to search the check-in files periodically to determine whether something needs claiming. This

method of claiming lacks control. Delays in claiming enhance the possibility that an item will be out of print; thus unavailable, which creates binding problems.

The OCLC system presents another set of problems. Access to the OCLC system is sometimes a problem to the library staff. Down time and terminal locations contribute to this problem. Other OCLC related problems include: quality of the database, time delay in getting catalog cards, lack of system retention of record modifications, serial record complexity, response time of the system, and problems with search entry algorithms.

The gathering of management information presents problems in the present library environment. Information is needed on: workflow analysis, vendor/publisher performance data, financial information, collection development information -- usage patterns, holding analysis, and weeding (discarding) information. Overall fund control is another of the present library problems. An example of this is the inability to encumber and accurately determine the current free balance of funds.

The branch and/or departmental libraries have their own unique problems, but their main problem is lack of good access to the resources of the main library.

E. A Special Problem

One major decision facing the library comes with the arrival and implementation of the Anglo-American Cataloging Rules, Second Edition (AACR II). This new set of rules is significantly different from the old set. These new rules will create educational problems for patron and librarian alike. The new rules create conflicts with the old rules. There

are several ways to implement the rules to minimize the conflicts. The library must choose the best way to implement AACR II for this particular library. The deadline for implementation is January 1981. The decision on future automation plans for the R. M. Cooper Library is fundamental to the approach that will be taken in the implementation of AACR II. The choice of alternatives may have a great impact on operating costs of the library.

F. System Requirements

The system proposed in this report must be capable of assuming the functions presently carried out by the manual tools currently used in the Library. The system must provide at least as good access to those items currently well controlled and better access to those items poorly controlled. Also, it must provide consolidated access and it should provide remote access to Library collections. The requirements of the system can be best understood by reviewing the characteristics of the present manual system.

The Library serves its users by organizing information and materials for easy access and retrieval and by making information and materials available to indivudual patrons. In order to use various library collections, patrons either seek staff assistance or they consult the card catalog, visible files, indexes, abstracts and other tools themselves. After locating citations through indexes, abstracts, online bibliographic retrieval services, and other tools, patrons must then use either the card catalog or the visible file to find call numbers and/or holdings information. The searching process is both complex and cumbersome. A

simplified overview is illustrated in figure 5. To illustrate the complexity of a library search, the process of accessing two of the better controlled collections is described.

1. Monographs. This is perhaps the simplest material to locate. After determining the appropriate entry term to use, the card catalog is consulted for bibliographic information and call number. If the book is not found in the card catalog, the library may not have it. However, it may be on order, or it may be in Acquisitions or Cataloging. Other files must be addressed to determine its status accurately. If the book is found in the catalog but not on the shelf, the circulation record must be consulted. The circulation record results from a batch computer operation so there is a possibility that an item may be in circulation but not appear in this record until the next day. In summary, the files to search for a monograph include:

a. Card Catalog (1st floor)

b. Circulation record (1st floor)

c. Acquisition file (ground floor)

2. Serials. Serials are also some of the best controlled items in the library. However, Serials searching is not simple, as the following points will illustrate. During the course of the interviews, it was determines that most users avoid the card catalog and consult the visible files directly for serials information. The visible file gives only partial bibliographic information and full holdings information for only part of the serials collection. The card catalog gives full bibliographic information for serial publications. The main visible file also does not give

issue by issue receipt information. To find this information, the Serials check-in record must be consulted. The main visible file does not cover all serials in the library. Other visible files/check-in records must be consulted, for instance those in the Agricultural Information Office and South Carolina Room. After determining holdings information should the journal be found to be checked out, or in Cataloging, or in Circulation (waiting to be reshelved), or in Serials, or at the bindery, or on order, further checking will be required to adequately determine status. The different files that may be checked in a serials search are:

a. Visible file (1st floor)

b. Card Catalog (1st floor)

c. Serials check-in files (ground floor)

d. Serials on-order file (ground floor)

e. Agricultural Information Office check-in/visible file (2nd floor)

f. South Carolina Room check-in/visible file (1st floor)

g. S&T Reference circulation record (2nd floor)

h. SS&H Reference circulation record (1st floor)

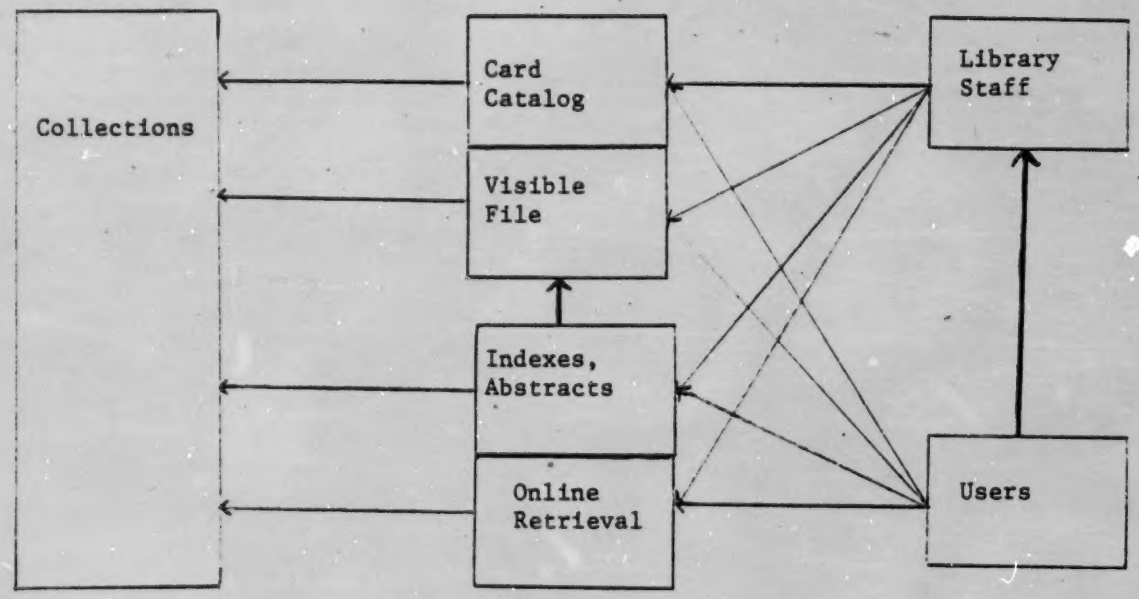


Figure 5: Access to collections

VI. OBJECTIVES OF PROPOSED SYSTEM

It was the intent of the Application Transfer Team to study the feasibility of an integrated online computerized library system for the Clemson University Library. Because of time constraints and the scope of the Library the team decided to concentrate on the serials area. In the preliminary study fifteen objectives of a comprehensive serials control subsystem were proposed. After evaluating each of the objectives it was determined some were not relevant and were deleted; others were combined and prioritized. The objectives of a serials control system are listed here.

1. To input bibliographic information that will provide access to the serials collection and other items in the library by author, title, subject, call number, ISSN/ISBN number and key word;

2. To provide cross references from variable terms to standard entry terminology as it exists;

3. To record and to provide for daily updating of the library's complete serial holdings and individual information on each title of current status of title, date started, missing issues, latest issue, special issue, financial data and microform holdings;

4. To claim original orders and successive receipts;

5. To control and display binding activity and to have the capability of generating bindery reminders, picking lists and bindery tickets;

6. To track status of items and display location through the technical processing workflow;

7. To display the physical location of items in the library;

8. To prepare periodic reports both, statistical and managerial, including:

   a. fund status, expenditure totals, encumberances,

   b. number of items bound and annual cost,

   c. vendor performance,

   d. circulation by title, call number, count and academic department,

   e. expenditures by discipline;

9. To interface with and link directly to other University systems such as the student data base and the financial information system;

10. To control fund accounting;

11. To contain and control vendor information by updating addresses and performance;

12. To control receipts of daily items such as newspapers.

VII. SYSTEM DESCRIPTION

A. Introduction

The proposed Serials System and the expansion of this system to other units will eliminate many of the present problems in the Library. It will also improve and expand the services offered by the library. Relieving librarians of some routine library tasks will improve reference services, online bibliographic retrieval, collection development, and bibliographic instruction.

Overall, improvements in access to information will eliminate many of the bottlenecks facing students and faculty who are involved in instruction and research. The ability to determine the availability of books and periodicals conveniently, even remotely, will improve the effort involved in preparing research proposals and in writing reports. An integrated library system starting with a Serials module will provide the needed ability.

An integrated library system at Clemson would include the following major subsystems:

1. Serials
2. Acquisitions
3. Cataloging
4. Circulation
5. Reference
6. Management and Statistical Reports

In addition, programs would be required for conversion of files and catalogs, for maintenance, and for tutorial facilities on usage of the system. Serials is the subsystem which will be discussed here, but it is important

to note that the implementation of the Serials subsystem would be planned to provide compatibility with the other subsystems as they are implemented. Serials control provides a microcosm of all library functions. As a result, the design and implementation of the serials subsystem will provide the foundation for and even some of the programs for other subsystems.

The primary objective of the Serials subsystem is to provide immediate campus wide access to serials information including bibliographic, holdings, status, order, and financial data and to reduce or eliminate the manual effort presently required for all types of serials transactions. This can be accomplished by maintaining required information in computer data bases and by providing online access via video display terminals to this information. The system would include security facilities to insure the integrity of the database while permitting access to various files by authorized users only. The users of the system could include patrons as well as library staff.

The Serials database would include most of the files necessary for the other major subsystems. Some of the files would contain data unique to the library such as bibliographic data. Other files, such as the student database, are already automated and utilized by various administrative systems at Clemson. The major components of the Serials database would include the following:

1. Bibliographic File
2. Authority Files and Indexes
3. Holdings
4. Binding File
5. In-Process Binding Index
6. Purchase Order

7. Library Accounts
    a. Encumbrances
    b. Accounting Transactions
8. Vendor File
9. Patron Files
    a. Students
    b. Faculty
    c. Other

Most of the information in the purchase order, library accounts, vendor and patron files is presently automated on the University computer system. However, all the data to be contained in 1 through 5 above would have to be converted from manual files.

The foundation of the library database would be the bibliographic file which would provide the facilities of an automated card catalog. This file could be accessible via online terminals from any location on campus. It would have multiple access points such as call number, title, author, subject, and keyword, and it would provide internal linkages and linkages to most of the other files. Each of the files will be discussed in more detail under Database Description below.

The Serials subsystem would include the following online modules.

1. Enter New Order
2. Receive New Order
3. Cancel Order/Standing Order
4. Order Replacement
5. Receive Replacement
6. Receive Issue (Standing Order)
7. Receive Items Not Ordered (Gifts, etc.)
8. Renew Subscription

9. Submit Binding

10. Receive Binding

11. Submit Claim

12. Cancel Claim

13. Enter or modify bibliographic records

In addition, there would be several batch modules to automatically trigger claims and binding transactions, as well as to perform maintenance and generate required reports. A more detailed discussion of the Serials modules is contained in Module Description below.

B. Database Description

The diagram in Figure 6 is intended to be a general schematic of the major blocks of information in the Library and the relationships among these blocks. The solid line implies a major and heavily used path, while a dotted line indicates an occassionally used but necessary path. In general, the Library Network should reference existing university databases where practical rather than maintaining duplicate information.

The major characteristics of the network are as follows:

1. Block B is the bibliographic description of a title. This is intended to be a complete description that could serve as the basis for an online catalog at some point. It will have a unique reference point, or key, such as call number or title, but it must also be accessible by author, subject, ISSN, as well as by title and call number.

2. Block H has an occurrence for each physical item in the Library under a given title. It contains information that is unique to the particular item rather than to the title. A holdings record is created

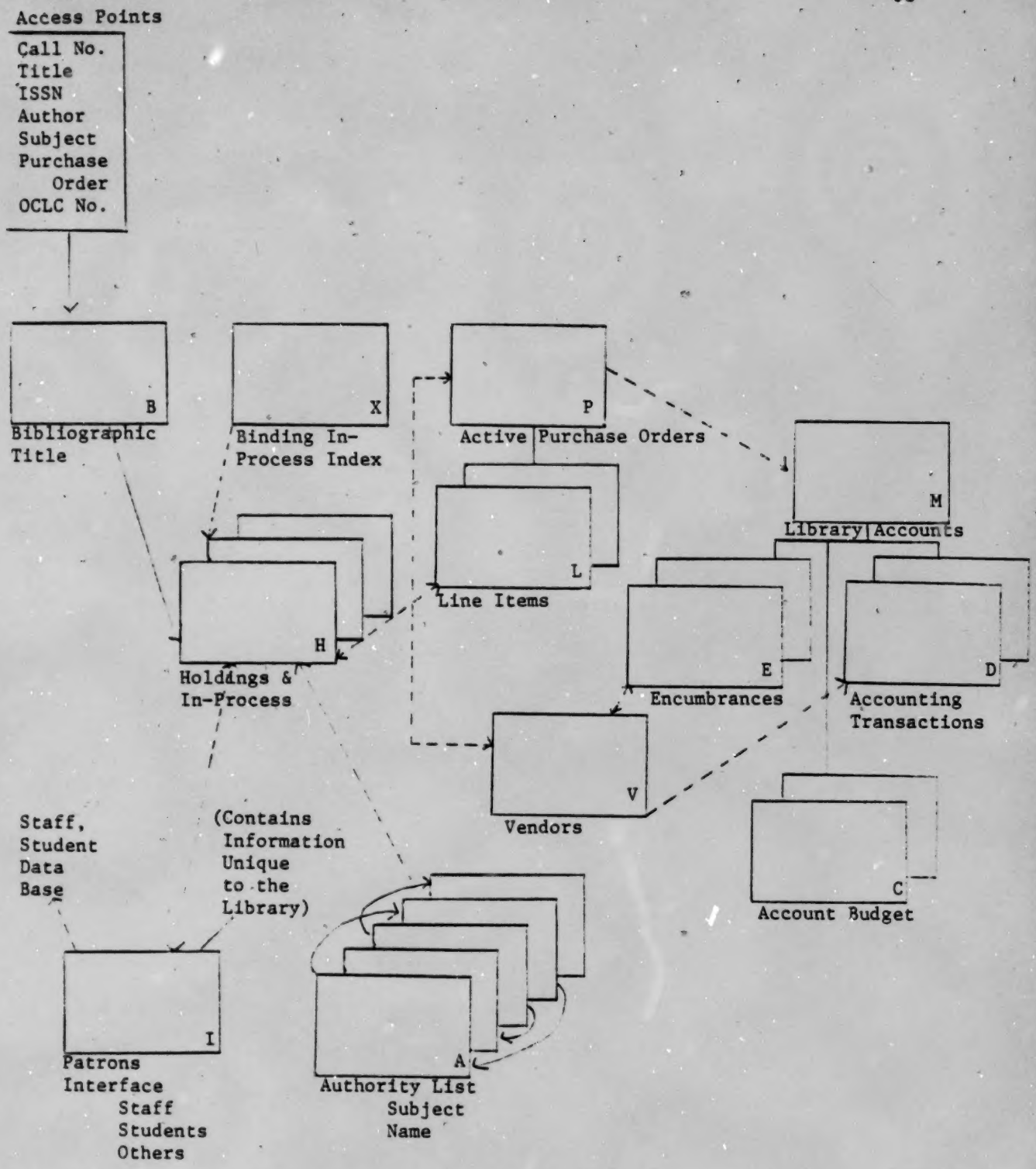


Figure 6: Database conceptual (logical) architecture

as soon as a purchase order for the item is prepared, and the holdings record permanently contains information pertaining to the item's purchase and payment history. While an item is on order, a cross reference to the purchase order information can be made to determine such information as account codes, payment status, and vendor information. The holdings record can also be referenced by the binding index, which at any point in time ties together in the database those items in-process for binding.

3. Block X is used as a reference point to search for items being bound, and can reference all such items or only those tied to a certain binding order.

4. Block P is referenced by purchase order number and contains all information necessary for a purchase order with appropriate dates. For a given purchase order there can be one or more line items (Block L) containing information unique to that item (receipt date, in-process disputes, disposition upon receipt, etc.). A complete description of the item being purchased is obtained by referencing the corresponding Block H and, if necessary, the corresponding Block B.

5. Block V contains such information as vendor name and address and is referenced (using vendor number) by Block P (purchase order). It also contains payment history for a given vendor and can be used as a starting point to inquire as to the status of a particular invoice.

6. Block M is present for each Library account under which it is necessary to budget, encumber, and record expenditures. It may or may not directly correspond to existing University 17 digit account numbers, based upon the needs of the Library.

7. Block E represents encumbrances against Library accounts created by purchase orders (one time or open).

8. Block D contains all accounting transactions for a given Library account, such as payments and corrections. Block D information can be referenced either by account number (Block M) or by vendor (Block V). The vendor path is used when it is necessary to reference detail payment information by vendor rather than by purchase order or account number.

9. Block A is the authority file which includes cross references from variants to the preferred forms of headings, and links from earlier to later forms and between broader and narrower terms and related terms. Areas included are name lists and subject lists.

10. Block I is a junction or bridge point from the Library network to the staff and student database. Block I contains patron information unique to the Library, such as items checked-out or delinquencies and status information. It carries name and address only for patrons not associated with Clemson University.

11. Block C contains the original budget and budget amendments for each fiscal year. There is a budget for each account number in the Library, allowing the Library to budget at the same level it spends. It may be desirable to budget across a group of account numbers, in which case Block C would move to a position above Block M (Library Accounts), implying one budget for a group of related accounts.

C. Table of Data Elements

The following is a partial listing of data elements in each information block. It is expected that this list will be expanded as a more detailed system definition is completed.

1. Bibliographic Elements
    a. Title
    b. Call Number
    c. Author
    d. OCLC Number
    e. Volume Number
    f. Date of First Volume
    g. Publisher
    h. Place of Publication
    i. Series
    j. Receipt Pattern
    k. Language
    l. Earlier Titles
    m. Later Titles
    n. Official organization
    o. Absorbed titles
    p. Contents
    q. Analytics
    r. Subject
    s. ISSN
    t. Volume Numbering Changes

2. Holdings Elements
    a. Purchase Order Number and Line Item
    b. Order Type
    c. Purchase Order Date
    d. Requesting Patron
    e. Requesting Patron's Department Number
    f. Last Claim Date
    g. Number of Claims
    h. Status Code
    i. Accession Number
    j. Location
    k. Format
    l. Volume
    m. Part
    n. Issue
    o. Series Number
    p. Copy
    q. Date of Receipt
    r. Checkout
        (1) Patron I.D. Number
        (2) Date
        (3) Checkout type
    s. Binding Code

3. Binding In-Process Elements
    a. Binding Order Number
    b. Vendor Number

c. Date of Order

d. Status of Order

e. Binding Specifications

f. Notes

g. Linkage to Holding items being bound

h. Expected receipt date

4. Purchase Order Elements

a. Purchase Order Number

b. Purchase Order Date

c. Vendor

d. Funds and Amounts

e. Line Item(s)

(1) Linkage to holdings record

(2) Unit of measure

(3) Quantity

(4) Expected receipt date

(5) Receipt date

(6) Status

(7) Unit Price

(8) Total Price

5. Vendor Elements

a. Vendor Number

b. Vendor Name

c. Vendor Address, City, State, Zip

d. Linkage to encumbrances for this vendor

e. Linkage to payments to this vendor

6. Account Elements
   a. Account Number
   b. Begin Date (Month and Fiscal Year)
   c. End Date (Month and Fiscal Year)

7. Account Transactions Elements
   a. Amount
   b. Date
      (1) Effective
      (2) Post
   c. Payee
   d. Transaction Code
   e. DR/CR Code
   f. Check Number
   g. Vendor Number
   h. Purchase Order Number
   i. Payment Code (Full or Partial)
   j. Batch Number

8. Encumbrance Elements
   a. Amount
   b. Date
   c. Payee
   d. Order Number (Purchase, Binding)

9. Account Budget
   a. Fiscal Year
   b. Amount

c. Budget Document Number

d. Increase/Decrease Code

e. Effective Date

10. Patrons Interface Elements

a. Patron I.D. Number

b. Linkage to holdings checked out or reserved

c. Delinquency status

d. Delinquency history

e. Name and Address of non-Clemson University users

f. Linkage to Personnel or Student Database for Clemson University users

11. Authority Elements

a. Name

b. Subject

c. Linkage to alternates (broader, narrower, variants, preferred forms, related, preceding, superceding)

d. Linkage to Library holdings

D. Module Description

A general description of the major functional modules will be given in this section. The objective of the system design is to provide an online facility to accomplish most of the transactions related to serials. Certain transactions are automatically triggered by batch runs made on a regular basis such as weekly or monthly.

1. Enter New Order - This module is a series of online transactions which will provide the user the capability to search the Bibliographic File in order to verify that Clemson does not already possess the item. The module will then enable the user to retrieve vendor information if required, create a purchase order record, a new basic bibliographic record, a new holdings record, and encumber funds for the order. This module will also generate a purchase order to be sent to the vendor.

2. Receive Order - This module is a series of online transactions which enable the user to access via a terminal all the files necessary to process the receipt of an order. The first online transaction enables the user to retrieve the bibliographic record created at order time and verify that the order is correct. Transactions are then available to update the holdings record, purchase order record, library accounts record, and to create a binding record. The module will also generate a notification to the requestor, routing information, etc. Data on outstanding claims will be processed when appropriate and claims cancellation notices will be produced automatically.

3. Cancel Order/Standing Order - This module provides a series of online transactions which enable the user to access and update the bibliographic record and holdings information. Access is also provided to the purchase order record and financial data so that the purchase order may be cancelled and the encumbrance relieved. This module generates a printed notification to the vendor.

4. Order Replacement - This module provides a series of online transactions that enable the user to access the bibliographic record and

purchase order or vendor record if required to obtain information necessary to generate an order for a replacement copy. Transactions are provided for creating a new purchase order record for the replacement item and updating holdings status. This module also generates a purchase order to be sent to the vendor.

5. Receive Replacement - This module provides a series of online transactions that enable the user to retrieve the bibliographic and purchase order records for the purpose of verifying that the order is correct. The purchase order record can be flagged for payment and holdings information can be updated. This module also generates a printed receipt notification. Data on outstanding claims will be cleared, and claims cancellation notifications will be generated automatically when appropriate.

6. Receive Issue - This module generates a series of online transactions to enable the user to check in periodical issues. Transactions are provided to update holdings information and purchase order data as needed. The module also will generate printed notifications and routing information if appropriate.

7. Receive Items Not Ordered - This module provides a series of online transactions which enable the user to create a new bibliographic record and holdings record(s). The module also generates printed acknowledgements, gift labels, etc. as appropriate.

8. Renew Subscription - This module provides online access to files which enable the user to inquire into and make necessary changes to the

bibliographic record, purchase order information, and library accounts data. The module also generates a renewal notice.

9. Submit Binding - This module provides a series of online transactions which enable a user to initiate a binding order from a terminal. Normally, a binding order with the appropriate notifications and lists will be generated automatically by a regularly scheduled batch run. This module provides access to the bibliographic, holdings, and binding records. It enables the user to update holdings information and create an in-process binding index showing all items composing the binding order. A printed picking list and binding slip are generated as output.

10. Receive Binding - This module is used to process all items returned from a bindery. It includes online transactions that enable the user to update holdings information and clear the in-process binding index for the order. A notification is printed indicating receipt of the bound items.

11. Submit Claim - This module provides a procedure for generating a claim from a terminal. Normally, claims will be automatically initiated by a regularly scheduled batch run. This module enables a user to access information in the Purchase Order File, Bibliographic File, and Holdings File necessary to generate a claim. The user can update previous claims information to reflect a new claim. The module also generates a printed claims notice.

12. Cancel Claim - This module enables a user to access the appropriate files from a terminal and change or remove claims information.

The module produces a printed claims cancellation notice to the vendor.

13. Enter or Modify Bibliographic Records - This module provides a mechanism for entering new or modifying old bibliographic information in the system. In addition, the system will provide a network of linked authority records and an appropriate means for maintaining control over the entry of bibliographic records.

In addition to the main online Serials modules discussed above, there may be a regularly scheduled batch run for the purpose of automatically generating binding orders and claims. This run will process the Holdings File sequentially and check fields indicating binding dates. An in-process binding index record is produced with linkages to each holdings record for items contained in the binding order. Status information in each holdings record is updated to show the binding status of the item. The run produces a picking slip for the Serials department and a binding slip (binding order) to be sent to the vendor.

The run also examines each holdings record to determine whether a claim should be generated. If the expected receipt date for an issue or new order has passed, a claim should be generated. If a prior claim has been outstanding over a specific period of time (to be established), a claim should be generated. In the event of a claim, the run updates the holdings record to reflect the claim and produces a claims notification to the vendor. The run should also generate a report listing all outstanding claims and binding orders as of the run date.

Other batch programs will be required in order to accomplish routine maintenance, such as consolidating holdings records for bound volumes,

reorganizing files, adding new records to certain files such as the patron files or vendor file. Additional online transactions will be required to provide a tutorial on the system as well as menu and prompting transactions to help users. In addition, programs must be provided for restart and recovery of the system when problems occur.

E. Other Library Subsystems

Many of the Serials subsystems modules provide online transactions which would be used by other areas of the library. The modules required for serials acquisitions will provide similar functions for monograph acquisitions, therefore, many of the same programs could be used. Holdings information will be less complex for monographs. The volume of new orders and the number of bibliographic records will be greater for monographs. However, the Serials subsystem will encompass most, if not all, of the requirements for Acquisitions.

Cataloging will require online access to bibliographic and holdings data. These capabilities will have already been provided in the Serials subsystem. The availability of a module which provides authority control will be needed from the beginning in order to assure the consistency of records and entry points as various subsystems are implemented. It is possible that additional access points or database linkages may be required, but most of the online transactions to inquire, update, add, or delete information will have been provided in Serials.

Circulation will require many of the transactions already developed for Serials. In addition, new online transactions would be required to enable library personnel to inquire on patron status (e.g. How many books

does this patron already have checked out? How many are overdue?), to check items out to patrons, and to reserve items for patrons. Capability to manage and to process fines will also be required in the Circulation subsystem.

Reference will utilize many of the online transactions in the Serials subsystem. The major additions required for Reference may involve transactions to generate inter-library loan requests or to request a new order. Reference will also use some of the online transactions discussed above for Circulation.

Management and Statistical Reports will also be produced by an integrated library system. Much information presently maintained in manual files will be readily accessible via online terminals. For example, financial account status will be accessible online. However, summary reports containing financial data as well as data on library usage, vendor performance, and holdings, will be produced periodically.

VIII. IMPLEMENTATION CONSIDERATIONS

A. Basic Factors

This section discusses strategies and factors which should be considered in planning the implementation of an integrated library information system at Clemson. There are several basic factors which should be considered fundamental to any strategy selected.

The first of these is to insure that the requirements of all the functional areas of the library are considered in the beginning so that compatibility between successively implemented subsystems will be maintained and the needs of each area will be met. This is particularly essential during database design. A second important consideration is the ability of the selected system approach to utilize information already available on Clemson's central computer including the student, personnel, and financial databases.

Another fundamental requirement for any automated system will be the conversion of bibliographic and holdings data to machine readable form. This task will be manual and one of the most time consuming. However, it can be and should be started as soon as possible since any automated system will require this data in machine readable form. The final determination of data elements and formats to be included in the automated bibliographic and holdings database should be made before conversion is begun. Some approaches for converting this data will be discussed later in this section.

One of the most important factors to successful implementation of an automated library system is the commitment of personnel from both DAPS and the Library to a joint effort. Involvement of people from both organizations throughout the implementation should be a requirement, whether a

system is developed inhouse or acquired from an outside source.

B. Alternatives

Three important areas for which there are alternate approaches are system development, operational environment, and conversion of bibliographic/holdings information. Decisions must be made on the approach to be taken in each of these areas, and these decisions will be based on cost factors, functional requirements, and feasibility considerations.

With respect to system development, there are two basic approaches: inhouse development or acquisition of an already operational system. The primary advantage of inhouse development is that the system could be completely tailored to meet Clemson's needs and conveniently employ portions of Clemson's existing databases. The primary disadvantage of this approach is the magnitude of the effort required and the timeliness of the result. Industry experience has shown that the development of integrated library systems is extremely complex, time consuming, and costly. The acquisition of a system which is already operational avoids much of the complex system design, programming, and testing effort. However, it may not result in a faster implementation. The primary disadvantage of this approach is that it is unlikely that a system could be found which totally fulfills all of Clemson's needs. Therefore, it is probable that some inhouse modifications and additions would be required. In order to utilize databases already on Clemson's computer system, modifications also would probably be necessary. Depending upon the amount of modification required, the acquisition of an already operational system could be considerably less expensive and require significantly less effort on the

part of Clemson personnel.

There are three approaches to the operating environment which must be considered before implementation begins. These approaches include an online system using Clemson's central computer, a distributed system communicating with the central computer but providing a certain degree of standalone capability, and a completely standalone system which does not communicate with or utilize the facilities of the central computer system. Each of these approaches provides some advantages and disadvantages. However, in Clemson's specific environment, some advantages are more significant than others.

The advantage of a system running online to Clemson's central computer is that the system would have access to all of Clemson's present databases as well as extensive data storage and processing capacities. It most probably would employ a high level programming language. The high level language and facilities available on the central system such as TSO would facilitate maintenance and modifications to the system. Another potential advantage of this approach is that there are probably many operational library systems available which are compatible with Clemson's central computer system. The primary disadvantage would be availability of the system. If the central facility were down for either scheduled or unscheduled maintenance, the Library terminals would also be down. It would be necessary to develop a method of operating manually for short periods of time, but this may be a requirement regardless of the approach taken.

The primary advantages of the distributed approach are availability of the system and access to the facilities of the central computer. This approach would provide the capability to continue basic operations such

as checkout even when the central computer is unavailable but would provide access to the databases, computing facilities, and data storage capacities of the central computer for most operations. The primary disadvantage of this approach is that there are probably no operational systems available today employing the distributed approach because of the newness of the technology. Therefore, some modifications would be required for any system already operational, or a system would have to be developed inhouse.

The primary advantage of a completely standalone system for the Library would be control of the system. The Library would not be dependent upon the schedule of the central computer for any of its operating functions. A secondary advantage would be the availability of standalone "turnkey" systems. There are, however, several disadvantages associated with this approach. Potential lack of availability on a campus wide basis is a very important one. Also, if the standalone system were down, the library would be required to operate manually. With no connection to Clemson's central computer, there would be no backup capability as would be the case with the distributed approach discussed above. While availability requirements for the central computer are high and provisions have been made to insure quick response to service calls and part requirements, it might be difficult to obtain similar levels of support of various standalone systems. Incompatibility with the central computer could be a serious problem which might make it difficult to take advantage of the facilities of the central computer for maintenance and backup or to access databases already available on the central computer. Most likely, it would be necessary for library personnel to assume responsibility for operation of a standalone system.

With respect to the conversion of bibliographic and holdings information, there are several approaches that can be taken. Two possible approaches for converting bibliographic data are to convert Clemson's current card catalog through keying techniques. The advantage of using OCLC is that the catalog data is already in machine readable form and can be obtained on tape. However, only a portion of Clemson's collection is available in OCLC. Therefore, it would be necessary to enter the remaining part of Clemson's card catalog via the OCLC terminals or utilize the OCLC entries that are already in machine readable form and modify them to meet Clemson's requirements. Either task would be extremely time consuming. Another problem with the OCLC approach is that the standards required by OCLC for serials cataloging may be too extensive for Clemson's needs and may be unnecessarily rigorous for an automated system at Clemson. The OCLC approach also would be cumbersome to use for converting holdings information.

The approach of directly keying Clemson's present card catalog would also be time consuming but would have the advantage of creating entries which have already been cataloged to meet Clemson's specifications. The process of keying the information directly to cards or magnetic media such as diskettes would be faster than data entry via the OCLC terminals and would be more convenient with no impact on the availability of OCLC terminals for other library operations. It is likely that part time data entry personnel could be utilized with minimum involvement of professional librarians. Holdings information could be converted the same way.

An additional approach to creating the database for the monographic portion of the collections involves the current circulation records. An eighty column IBM card with accession number, truncated title and call

number exists for every item in the circulating collection. These cards may form the basis of a file which could be upgraded by means of an algorithmic match against a nationally available database.

C. Cost Estimates

A general estimate of implementation and operating cost can be provided here, but the actual cost will obviously depend upon the approach taken and the degree to which an automated system is implemented. The cost associated with the system can be divided into the following three major components: conversion of bibliographic and holdings data, implementation of the automated system, and ongoing operating cost.

With respect to the conversion of bibliographic data, there are approximately 30,000 serial titles in the card catalog. It is estimated that there are about 10,000 holdings records in the "visible file." On the basis of approximately 500 characters per average bibliographic record and 500 characters per average holdings record, this would total about 20,000,000 characters of information to be keyed. Although professional data entry personnel can key data faster, we will assume a rate of 5,000 characters per hour. This would result in an estimate of 4,000 hours of keying. At $7.00 per hour, including overhead rates, the estimated cost of keying the current bibliographic and holdings data would be $28,000. In addition, it would be necessary to write programs to format and load these records to a computer file. Although these programs would require some effort, their cost would probably be insignificant when compared to the total conversion cost. The conversion of records for monographs via this approach would increase the cost to $217,000.

The cost of system implementation depends upon the approach taken, e.g., whether the system is developed inhouse or whether an operational library system is acquired and modified to meet Clemson's requirements. For comparison purposes, a general estimate of the minimum effort required to develop the system inhouse is provided here, as well as the known cost of an available operational library system which is compatible with Clemson's central computer.

The section of System Description defines the functional components of the required library system and provides a fairly detailed description of one of those components, the Serials subsystem. Twelve online modules were identified for Serials. It is estimated that about 1,000 man-days of effort would be required to design, code, and test these programs. In addition, at lease one major batch run would be required for automatically generating binding and claims transactions. It is estimated that about 200 additional man-days will be required for the development of this batch run and other batch programs necessary to maintain the system. There will also be additional programs for providing tutorial, menu, and other "help" type online transactions, but these have not been included here. The total estimate of the minimal effort required for inhouse development of the Serials subsystem is therefore approximately 1,200 man-days or about four man-years if nonproductive time is taken into account. Since many of the modules required for the other library subsystems and almost all the required databases would have been implemented for Serials, it is estimated that the effort required to implement all the remaining subsystems would be approximately equal to that required for the implementation of Serials. This would give an estimate of about eight man-years for the implementation of the complete integrated library system. This equates to

about $300,000 to $320,000 in direct and indirect cost for system design, programming and testing. The cost of machine time, facilities, and supplies might be substantial but has not been included here.

For the sake of comparison, one operational library system which is available today is the Dortmund/Leuven Library System (DOBIS/LIBIS) This system has three components: the Dortmund system for online cataloging and searching, the Leuven system for online circulation and acquisitions, and the Leuven batch system for the production of catalog cards, accession lists, COM catalogs, and documents for acquisition and circulation. Taken together, these systems fulfill most of the requirements identified by this study, although some additional coding and modifications would be required. The three components are available at a cost of $49,800. They require the IBM CICS terminal control program for terminal communications. This IBM program product rents for approximately $1,000 per month.

The Dortmund/Leuven System and all other operational library systems which are considered should be carefully evaluated on the basis of how well they will interface with present Clemson systems, how much modification or additional coding will be required for them to fulfill Clemson's needs, and how easily they can be maintained. Ease of operation and ongoing operational costs should also be considered.

Ongoing operational costs are often overlooked when evaluating different alternatives for system implementation. No attempt will be made here to estimate the operational cost of a library system at Clemson, but various cost components will be identified. Equipment cost includes terminals for each functional area of the library and the cost of facilities at the central computer center. If the system is an online system to Clemson's central computer, the entire database would reside on the central

computer, and all processing would be done there. If a distributed approach is taken, some of the database might be maintained on the distributed system at the library and some on the central computer. Processing would be split between the central computer and the distributed system. In the case of a standalone system, all processing and data would be at the standalone system. In the cases of the centralized online approach and the distributed systems approach, no additional operations personnel would be required. In the case of a standalone system, someone most likely would be required to operate the system.

All application systems require periodic maintenance and undergo continuous enhancements. Some effort should be made to evaluate the effort that will be required to do this. For example, a system implemented using a high level programming language and standard access methods for access to terminals and to the database will be more easily maintained, modified, and enhanced than one which is written is assembler and employs non-standard access methods. A system which runs on the central computer will most likely be more easily maintained than a standalone system which is incompatible with the central computer.

D. Summary

The fundamental considerations relating to implementation approaches for a library system at Clemson include the degree of compatibility between subsystems, the ability of the library system to utilize current operational databases on Clemson's computer system, the conversion of bibliographic and holdings information to machine readable form, and the involvement of personnel from both the library and DAPS throughout the project. Several

decisions must be made regarding inhouse development of a system verses acquisition of an operational system developed elsewhere, the operational environment which will be implemented, and the method of converting bibliographic and holdings information.

The magnitude of the task of implementing an integrated library system is great, regardless of which approach is taken, but there are specific advantages and disadvantages associated with each. The implementation plan must begin with a careful examination of the alternatives and which approach is best suited to Clemson's requirements.

IX. COST/BENEFITS

A. Introduction

The library Serials System is being proposed because the system will provide a number of benefits.

1. Information on library holdings to:
   a. Patrons in the library,
   b. Faculty, staff and students on other parts of the campus,
   c. Administrative staff on campus,
   d. Library staff,
   e. Staff and patrons in branch libraries.

2. Status on library materials including:
   a. Location of items,
   b. Availability of unbound issues,
   c. Tracking of new items through library processing.

3. Elimination of multiple files

4. Simplification of work activities
   a. Cataloging
   b. Binding
   c. Acquisitions
   d. Serials control

5. Improved searching capability through:

   a. Additional access terms such as keyword from bibliographic records,

   b. Improved control of terminology.

6. More accurate and complete management information on:

   a. Fund utilization,

   b. Collection use,

   c. Vendor performance,

   d. Workflow analysis.

B. Costs

1. Cost of implementing Serials and other subsystems by inhouse developed programs:

	Estimated Man-hours	Estimated Personnel Cost
Serials	9,600	160,000
Cataloging Acquisition Circulation Reference	9,600	160,000
	Subtotal	$320,000
Serials Data Conversion		$ 28,000
Monographs Data Conversion		217,000
	Subtotal	$245,000
	TOTAL	$565,000

C. Benefits

The Library's mission and function is to store information and to provide effective access to that information for its users. Clemson Library has relied on standard library practice, prevailing technology, and the professional skills of its librarians to perform these services. Any new library system instituted at Clemson must enhance the library's role by enriching user service, simplifying retrieval of information and controlling library records in a comprehensive, useable and efficient procedure that the library staff can easily maintain. The value of these benefits and savings over the existing operation should offset the cost of acquisition of an integrated system if it is to be a valid project.

The primary benefit of Clemson's proposed integrated library system is the increased accessibility of library records by campus-wide access, additional search term capability, broad range of a system-controlled library resources, and real-time processing. The online system can be queried from any point on campus that houses a CRT unit and will afford significant savings in time and effort for faculty and students who can use library data from remote terminal stations. A faculty member researching a proposal topic can determine from his own office or building if the materials he needs are in the library's holdings. A student can search the library's collection from dormitories or classrooms around campus to identify items without having to make a frustrating or futile trip to the library.

The system will retain traditional bibliographic access points and will expand retrieval approaches through author and title analytics, keyword access, and internationally recognized bibliographic numbers. Author and title analytics will be included in the library record to provide a valuable approach to individual volumes that are cataloged collectively

under a series name. Keyword access is a powerful tool in information retrieval because library patrons often have incomplete or incorrect bibliographic information. Keyword access allows increased capacity to a vague or unsophisticated search strategy. The library world has defined internationally recognized and authoritatively assigned unique numbers for published materials. These numbers which are known as the ISBN (International Standard Book Number) for monographic items and the ISSN (International Standard Serial Number) for serial publications will be included in the machine readable records. ISBN and ISSN access will allow definitive and rapid retrieval when these numbers are given as part of a bibliographic citation.

The proposed system will also encompass an enlarged number of library resources by including records for all serials on campus. Currently, serials kept in the Architecture Library and Sirrine Library are not cataloged and are known to the public in the main library only through the visible file (the public record listing bound serial volumes) or through the annually updated list of periodical and continuation titles held by Clemson. The full scope of monographic and serials holdings can be completed by adding records for government documents, microforms and presently uncontrolled items as the system becomes established and fully operational.

The integrated system will mesh all information from the various operational units of the library into one record that will be updated in real-time. The basic record will include all ordering, bibliographic, holdings and status information that pertains to any item in the library, and will display updated information immediately as changes are made. Serial publications especially will recognize a significant advantage since under

the established operation the status of a serial item must be determined from various files. Bound volumes are listed in five different visible files, depending on which unit of the library is responsible for processing the particular title. The main visible file, located on the main floor of the library, is the responsibility of the serials department. It lists most of the bound serials held by Clemson. However, Science, Technology and Agriculture Services (ST&A), the South Carolina room, the Architecture Library and Sirrine Library also have individual files for bound bolumes of serial titles they acquire and process. Even though information on bound serial volumes is located in these public visible files receipt information of individual, unbound issues resides only in the check-in records of the responsible processing unit and is known to the public only by contacting that unit for information. The staff of the serials department provides most of this information through inquiries from the reference staff or by direct contact from the patron. But at night and on weekends, when the serial area is closed, the public service librarians must personally go to the check-in record. This entails securing the appropriate key to unlock the serials department and leaving the reference desk unattended for the duration of the trip.

The receipt situation of individual periodical issues is only one status problem of serials. Bound serial volumes and unbound periodical issues, except the most current, are allowed to circulate for a few days but there is no central location to check on the circulation status of periodicals. Serials are checked out manually at the reference desk located in the area where the title is shelved, and a manually maintained serial circulation file is kept at each reference desk. This process accounts for numerous interruptions in the workflow of the professional

staff and for a cumbersome, inefficient file for periodical circulation information. A week long survey on aspects of serial receipt and circulation status demonstrates the magnitude of the problem. During this survey thirty-seven patrons in ST&A were directed to the main visible file one floor below simply to determine the disposition of a serial volume. This implies that that same person might have determined that the volume he desired was bound and on the shelf, and have return to the ST&A area where he originally began his search. In the same week the serials department responded to ten visits and twenty-six telephone calls from people seeking information on the location or receipt of unbound current issues. Each transaction required between three to five minutes of staff time. Nine trips to the serials department, representing about fifteen minutes each, were recorded by the public service librarians that week to locate check-in information of unbound periodicals. That represents a little over two hours of their time in one week, and two hours when the reference desk was left unattended.

The results of this survey, figured on a fifty week year, indicate that in one year approximately 1,750 library patrons are sent from the ST&A area alone to determine volume status of periodical titles shelved in the ST&A area. In one year approximately 120 hours of library technical assistant time and 112 hours of professional librarian time is absorbed in the search to identify the status of unbound periodical issues. Additionally, circulation statistics show that approximately 200 hours of professional and 200 hours of clerical time is spent in the manual circulation of more than 20,000 serial and reserved serial items. The proposed system represents savings in time and frustration on the part of user and staff alike in identifying the exact, current status of periodical items from the various points throughout the library having a CRT. An additional benefit

is that the library patron will need instruction in the use of only one tool to investigate all library records.

The significant advantages of a single file for all bibliographic/holdings/status information that will accrue to the user will afford tremendous benefits to the library staff who originate and maintain these records. Once a record is input into the system it can be revised and refined as it progresses through the processing operation. All information of every record will be accessible to the librarians and, depending on the level of assigned duties, each librarian can update that portion of the record for which he is responsible without replicating any of it for a separate departmental file. Multiple files of similar information and manual filing will be eliminated, as will both the chance for error that arises when information is transferred from one record to another and the proofreading that insures accurate data transfer.

The proposed integrated system has many operational capabilities that will represent time savings over the manual procedures that currently exist. The machine readable library records with traditional bibliographic information, expanded access points, and holdings information will constitute an online catalog and will replace the five card catalogs currently located at Clemson. The official card catalog, situated in the main library, and the auxiliary catalogs containing records that pertain to the collections they represent, are now manually filed and maintained. On an annual basis the filing requires about 4,750 hours of staff time and about 500 hours of professional time to revise for accuracy. The online system will eliminate this manual procedure and will relieve the tedious manual aspects of catalog maintenance. Since the catalog is a living organ of the library it not only grows with new acquisitions but must be continuously groomed by modifying records to reflect changes in entries or headings. Subject

heading changes frequently require sweeping and massive adjustments in catalog cards and accounts for about half of the duties of one high level library technical assistant. An online system will automatically update these obsolete headings with a minor amount of effort from a library assistant.

A significant benefit to be recognized from the proposed system is its capability to deal with an important event for the library world. In 1981 standard cataloging practice will be drastically altered with the implementation of the Anglo-American Cataloguing Rules, Second Edition (AACR II). These new rules provide for significant differences in form of entry that will create conflicts with existing entries in the library catalog. Beginning in January 1981 the Library of Congress plans to implement AACR II, and any library that uses MARC records or relies on shared network cataloging must be prepared to deal with the implications of this new code. To accomodate the new cataloging rules by manually changing all existing conflicting records would be an astonomical project. The proposed online system could easily adjust the machine readable records to bring all variations of an entry into one uniform structure. The ease and flexibility of updating machine readable records will allow for many and varied adaptations of records as future needs are defined by the dynamic field of library organization and information retrieval.

Chief among functional benefits of the integrated library system are those capacities for an automated system to alleviate the tedious, routine procedures associated with serials management. The diverse and changing nature of serial publications demand close and vigilant control if they are to be of maximum use to the university community. The current environment of serials control relies on manual functions to encumber funds, claim

and bind. The present procedure for ordering, encumbering, typing multiple forms and manually filing requires about 1,800 hours of staff time. Claiming unreceived issues is initiated by an annual review of check-in records (except those items that come to the attention of the check-in clerk with subsequent receipts) individually examined for delinquent receipts. The total claiming process, including identification of claiming needs, letter transmission, file maintenance and record updating absorbs over 5,000 hours of clerical time every year. Binding activity associated with the typing of bindery forms, bindery lists and posting of bindery status of serials volumes on the visible file requires over 640 hours a year of clerical effort. All of these functions lend themselves naturally and efficiently to a computer generated function that will automatically encumber funds, produce claim letters and binding tickets and update the status information of any serial volume at any stage of the receipt or binding stage. These capabilities alone could release at least two clerical workers for other library duties. By shifting clerical personnel away from functions ably executed by the computerized system the library could maintain staff size to its present limit, rather than hire additional staff to maintain manual operations.

The library prduces annually a list of titles called Clemson University Periodical and Continuation Titles that is distributed throughout the campus. Although it is a useful list it is neither complete nor up-to-date. The list is printed on the computer by batch processing from keypunched cards maintained by the Serials Specialist at a cost of about three months of her work time. The proposed integrated system will make such a list unnecessary since there will be campus-wide access to the current status of all serials through the online system. Should the list of titles still be desired for off-campus distribution it could be auto-

matically generated from the machine readable serials records.

Of significant use to the library administration and university decision makers will be the gathering of library statistics for management reports by the new system. Currently, except for the circulation system, all statistical information is collected manually and does not include a comprehensive range of library data. The computerized system can easily gather data and sift it to clarify various management requirements.

So that the integrated library system will take advantage of existing university facilities it will tie into established machine readable files on campus, such as the accounting system and the student database. The library will thus avoid replicating existing information and will realize a savings of time and cost in the implementation of the new system.

The prominent focus of this proposed system is to merge and minimize input requirements, while simultaneously expanding and diffusing output capabilities. The elimination of duplicate record processing and the instant, campus-wide access to all bibliographic, holdings and status information of system-controlled items give a rational foundation for the development of an itegrated library system.

D. Cost/Benefit Match

Cost displacements are possible when the Library system is fully implemented. It is also realistic to expect greatly improved services to accrue to students, faculty, and staff served by the Library because of the system. These benefits are outlined in part C of this section, but no attempt is being made at this time to assign dollar value to these benefits.

The dramatic dollar impact of this system will be in the use of more complete and accurate information by students and faculty in their instructional and research activities.

E. Potential Payback

The system implemented will provide cost savings by reducing the number of staff positions added in the future and by eliminating repetitive and tedious tasks.

1. Cost avoidance of added positions based on the growth of volume activity.

	1980-1980	$ Estimated avg/yr
Serials	2	32,000
Cataloging	3	48,000
Acquisitions	1	16,000
Circulation	1	14,000
	TOTAL	$110,000

2. Reduction of repetitive tasks of typing, filing, and revising.

Serials:	Claiming	2,500 man-hours per year	
	Binding	642 man-hours per year	
	Ordering	1,000 man-hours per year	
		3,242 x 5 years	
		16,210 man-hours	$120,000
		TOTAL	$120,000

Other Subsystems:	Accessioning	600 man-hours per year	
	Typing	500 man-hours per year	
	Filing	4,750 man-hours per year	
	Revising	1,500 man-hours per year	
		7,350 x 5 years	
		36,570 man-hours	$272,000
		TOTAL PAYBACK	$502,000

3. a. Net Cost for serials subsystem development inhouse over 5 years.

Costs	Cost avoidance	
System	Staff not added	
160,000	32,000	
Data conversion	Task reduction	
28,000	120,000	
	TOTAL	$36,000

b. Net Cost for total integrated system over 5 years.

Costs	Cost Avoidance	
System	Staff not added	
160,000	78,000	
Data conversion	Task reduction	
217,000	272,000	
	TOTAL	$27,000

4. Net savings based on purchase of an integrated system (Dortmund/ Leuven example) over 5 years.

System	Cost Avoidance	
49,800	Staff not added	
Data conversion	110,000	
217,000	Task reduction	
CICS	392,000	
60,000		
	TOTAL	$175,100

X. RECOMMENDATION AND PLAN OF ACTION

A. Introduction

It is recommended that Cooper Library improve the service it offers to students and faculty through the phased implementation of several automated enhancements within the functional areas of the library. Major efforts should concentrate on improving control of and access to periodicals. Initial and succeeding efforts should involve the circulation, acquisitions, and cataloging functions. The implementation sequence is diagramed in Figure 7.

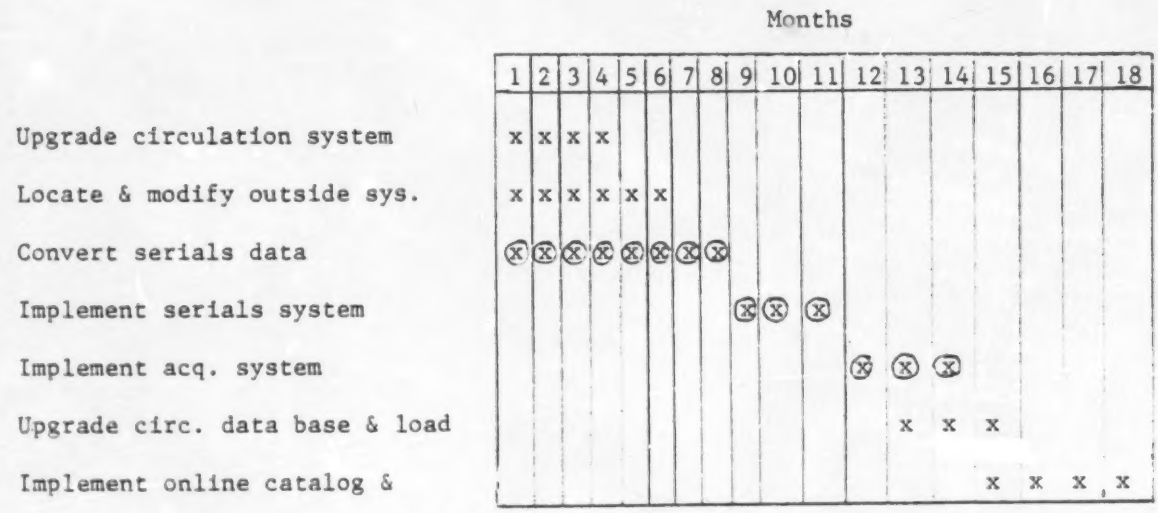

Months
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Upgrade circulation system
Locate & modify outside sys.
Convert serials data
Implement serials system
Implement acq. system
Upgrade circ. data base & load
Implement online catalog &
Reference Functions
⊗ = critical path

Figure 7: Chart of plan of action

B. Strategy

The implementation of improvements in services shall proceed in a series of steps which are summarized below. The steps shall be initiated with endorsements of this report and approval to proceed. They shall be implemented under the combined leadership of the Associate Director of the Library and the Director of DAPS.

1. Upgrade the current circulation system to provide online access to data.

The current circulation system provides information about items in circulation, and patron information by means of daily batch produced, printed reports. These reports average several hundred computer printout pages each day. Upgrading of the system to allow online access to patron information will eliminate most of the printouts and will provide real-time access to information about the current day's activity.

2. Identify, evaluate and acquire a currently available library system which will provide serials control.

The search for a system will be based upon the characteristics and capabilities of the serials system described in this report. Evaluation will be determined in relation to candidate systems' ability to fulfill as many of the objectives as described in part VI of this report as possible. Assistance with identifying and evaluating potential systems will be provided by retaining a nationally recognized consultant on Library automation systems. The system obtained will be chosed on the basis of the evaluation, cost, and potential for modification to make it link appropriately to other systems and Clemson hardware. The system must

provide a mechanism such as authority control to insure that entries made into the initial subsystem will be consistent with other subsystems as they are implemented.

3. Begin immediate conversion of serials information.

The bibliographic, holdings and financial information currently residing in the card catalog and several files will be consolidated and converted to a machine readable format. The record structure used will be based upon the Marc 2 format. This format will be used in order to make the data available in an international standard format so that it can be readily reformatted into the record structure required by the serials system chosen. This conversion effort should be initiated as soon as possible upon approval to proceed, by the most effective technology available and by a team composed of members of the Serials and serials cataloging units. Data converted to machine readable format will form the basis of the database for the serials system installed. Bibliographic data entered will be made consistent by means of authority control.

4. Install and implement the serials system.

Pending acquisition the DAPS will install the system. Implementation of programs will commence with the loading of converted records and production of purchase orders. Installation will include modification and adaption of the system to operate in the Clemson computing environment.

5. Implement modifications and procedures to use the system for monograph acquisition purchases.

Following several months of successful use of the Serials System for

serials control and access, it will begin to be used for the purchase of monographs. This use will largely affect the growth of the bibliographic database. Some period of use for acquisitions will result in the development of a database which will represent a significant portion of total holdings of the Library.

6. Upgrade Circulation database and load.

All holdings of the library are currently represented by a file of computer cards which contains one 80 character record for each physical item in the collection. These will be matched against a nationally available database of Marc records. The matching process will upgrade the records by adding subject headings and secondary author headings. This will constitute a new data file which will be merged with the serials and acquisitions database in the operating online system. The resulting database with subject access will offer virtually all the capability of a complete online catalog for all the library's holdings, thus displacing the continuance of the card catalog.

7. Develop and implement final modules.

Modules to provide online circulation and management information reports will be implemented in the final phase. The circulation system will be upgraded to a module of the library integrated system to allow online circulation in a real-time mode and to provide for access to current days activity.